

- 29 -

What is claimed is:

1. A metal cluster nanocompound of transition metals,
comprising a metal core and at least one ligand,
5 and physiologically tolerated salts, derivatives,
isomers, hydrates, metabolites and prodrugs
thereof,

10 with the average size of the metal core of said
metal cluster nanocompounds and/or the
electronegativity of said metal cluster
nanocompounds and/or the stabilization energy
being selected in a way so as to enable said metal
15 cluster nanocompounds to interact with the DNA,
preferably B-DNA, of human or animal cells, in
particular of tumor or cancer cells, preferably
under physiological conditions,

20 for the prophylactic and/or therapeutic (curative)
treatment of disorders of the human or animal
body.
2. The metal cluster nanocompound as claimed in claim
1, in which the interaction between said metal
25 cluster nanocompound and the DNA takes place by
way of physical and/or chemical bond(s) and/or
interaction(s).
3. The metal cluster nanocompound as claimed in claim
30 1 or 2, in which the stabilization energy ΔE^{stab} of
the interaction(s), in particular bond(s), between
said metal cluster nanocompound (MCN) and the DNA,
in particular B-DNA, calculated as a potential
35 difference between, on the one hand, the sum of
the potential energies of the ligand-free metal
core of said metal cluster nanocompound, $E^{\text{pot}}_{\text{MCN}}$,
and the free DNA, $E^{\text{pot}}_{\text{DNA}}$, and, on the other hand,
the potential energy of the resulting complex of
the ligand-free metal core of the metal cluster

BEST AVAILABLE COPY

-30-

nanocompound and DNA, $E^{\text{pot}}_{\text{MCN-DNA}}$:

$$\Delta E^{\text{stab}} = (E^{\text{pot}}_{\text{MCN}} + E^{\text{pot}}_{\text{DNA}}) - E^{\text{pot}}_{\text{MCN-DNA}}$$

- 5 is, under normal conditions, at least about
-400 kJ/mol, in particular at least about
-625 kJ/mol, preferably at least about
-825 kJ/mol, particularly preferably at least
10 about -1000 kJ/mol, very particularly preferably
about -1200 kJ/mol.
4. The metal cluster nanocompound as claimed in any
of claims 1 to 3, in which the average size of the
metal core of said metal cluster nanocompounds is
15 selected in a way so as to enable said
nanocompounds to attach to the major grooves of
the DNA molecules, in particular of B-DNA.
5. The metal cluster nanocompound as claimed in any
20 of claims 1 to 4, in which the metal cores of said
metal cluster nanocompounds have an average size
of no more than about 2.5 nm, in particular of no
more than about 2.0 nm, preferably of no more than
about 1.6 nm, particularly preferably of no more
25 than about 1.5 nm, very particularly preferably of
about 1.4 nm, and/or in which the metal cores of
said metal cluster nanocompounds have an average
size of at least about 0.5 nm, in particular of at
least about 0.75 nm, preferably of at least about
30 1.0 nm, particularly preferably of at least about
1.3 nm.
6. The metal cluster nanocompound as claimed in any
of claims 1 to 5, in which the metal core of said
35 metal cluster nanocompounds has at least 30 metal
atoms, in particular at least 40 metal atoms,
preferably at least 50 metal atoms, particularly
preferably at least 55 metal atoms, and/or in

-31-

- which the metal core of said metal cluster nanocompounds has no more 90 metal atoms, in particular no more than 80 metal atoms, preferably no more than 70 metal atoms, particularly preferably no more than 60 metal atoms.
- 5
7. The metal cluster nanocompound as claimed in any of claims 1 to 6, in which the transition metal is selected from the group consisting of platinum (Pt), gold (Au), rhodium (Rh), iridium (Ir), palladium (Pd), ruthenium (Ru), osmium (Os) and silver (Ag) and also mixtures thereof, preferably from the group consisting of platinum (Pt), gold (Au) and ruthenium (Ru) and also mixtures thereof, and is preferably gold (Au).
- 10
- 15
8. A metal cluster nanocompound of transition metals, comprising a metal core and at least one ligand, and physiologically tolerated salts, derivatives, isomers, hydrates, metabolites and prodrugs thereof, in particular as claimed in any of claims 1 to 7,
- 20
- in which the metal core comprises from 50 to 70 metal atoms, preferably 55 metal atoms, and/or
- 25
- in which the metal core consists of atoms of transition metals from the group consisting of platinum (Pt), gold (Au) and ruthenium (Ru), in particular of gold atoms, and/or
- 30
- in which the metal core is an Au₅₅ core and/or
- in which the metal core, including the ligand(s), has an average size of from 1 to 5 nm, in particular 2 to 3 nm, preferably about 2.5 nm, and/or
- 35
- in which the metal core has an average size of

-32-

from about 0.5 nm to about 2.5 nm, in particular
from about 1.0 to about 1.5 nm,

- 5 for the prophylactic and/or therapeutic (curative)
treatment of disorders of the human or animal
body.
9. The metal cluster nanocompound as claimed in any
of claims 1 to 8, which is soluble or at least
10 dispersible in aqueous media, in particular under
physiological conditions, in particular due to the
selection of suitable ligands.
10. The metal cluster nanocompound as claimed in any
15 of claims 1 to 9, in which the ligand(s) may be
organic radicals and/or halogens, preferably
chlorine, and are selected, in particular, from
the group consisting of the group consisting of
triphenylphosphine and its derivatives, in
20 particular sulfonated derivatives; halogens, in
particular chlorine; and mixtures thereof.
11. A metal cluster nanocompound, in particular as
claimed in any of claims 1 to 10, which has the
25 general formula (I)



where:

- 30
- M is a transition metal atom which may be
selected preferably from the group consisting
of platinum (Pt), gold (Au), rhodium (Rh),
iridium (Ir), palladium (Pd), ruthenium (Ru),
35 osmium (Os) and silver (Ag) and also mixtures
thereof, particularly preferably from the group
consisting of platinum (Pt), gold (Au) and
ruthenium (Ru) and also mixtures thereof and
which is very particularly preferably gold

-33-

(Au), it being possible for M to denote identical or different metals in the same metal cluster nanocompound;

- 5 • n is the number of transition metal atoms per metal cluster nanocompound, with n being at least 30, in particular at least 40, preferably at least 50, particularly preferably at least 55, and no higher than 90, in particular no higher than 80, preferably no higher than 70, particularly preferably no higher than 60, and, very particularly preferably, is in the range from 50 to 70;
- 10 • L is a ligand, in particular an organic radical, and may denote identical or different ligands in the same molecule;
- 15 • m is the number of ligands per molecule and is at least 10, in particular at least 12, preferably at least 18;

20 and physiologically tolerated salts, derivatives, isomers, hydrates, metabolites and/or prodrugs thereof

25 for the prophylactic and/or therapeutic (curative) treatment of disorders of the human or animal body.

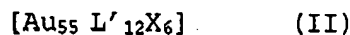
12. The metal cluster nanocompound as claimed in claim 11, in which M = Au and/or n = 55.

30 13. The metal cluster nanocompound as claimed in claim 11 or 12, in which the ligand L is selected from the group consisting of triphenylphosphine and its derivatives, in particular sulfonated derivatives; halogens, in particular chlorine; and mixtures thereof.

35 14. A metal cluster nanocompound of the general formula (II), in particular as claimed in any of

-34-

claims 1 to 13,



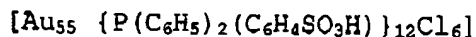
5 where

- L' is a ligand, in particular an organic radical, where L' may denote identical or different ligands in the same molecule and L' is in particular a triphenylphosphine radical or its derivatives, in particular sulfonated derivatives, particularly preferably $\text{P}(\text{C}_6\text{H}_5)_2(\text{C}_6\text{H}_4\text{SO}_3\text{H})$, very particularly preferably $\text{P}(\text{C}_6\text{H}_5)_2(\text{meta-C}_6\text{H}_4\text{SO}_3\text{H})$,
10
- X is a halogen atom, preferably chlorine, and
15 may denote identical or different halogen atoms in the same molecule;

and physiologically tolerated salts, derivatives, isomers, hydrates, metabolites and/or prodrugs thereof
20

for the prophylactic and/or therapeutic (curative) treatment of disorders of the human or animal body.
25

15. A metal cluster nanocompound of the formula

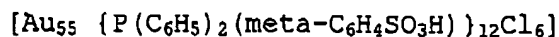


30 and physiologically tolerated salts, derivatives, isomers, hydrates, metabolites and/or prodrugs thereof,

in particular for the prophylactic and/or
35 therapeutic (curative) treatment of disorders of the human or animal body.

16. A metal cluster nanocompound of the formula

-35-



5 and physiologically tolerated salts, derivatives,
isomers, hydrates, metabolites and/or prodrugs
thereof,

10 in particular for the prophylactic and/or
therapeutic (curative) treatment of disorders of
the human or animal body.

15 17. The metal cluster nanocompound as claimed in any
of claims 1 to 16, characterized by good water
solubility, in particular a water solubility of at
least 0.1 $\mu\text{mol/l}$, preferably at least 1.0 $\mu\text{mol/l}$,
particularly preferably at least 1 mmol/l or more,
and up to 100 mmol/l and more.

20 18. The metal cluster nanocompound as claimed in any
of claims 1 to 17 for the prophylactic and/or
therapeutic (curative) treatment of neoplastic
and/or cancerous disorders of the human or animal
body, in particular of primary tumors and/or
metastases and/or precancerous diseases (pre-
cancer stages), in particular for the prophylactic
25 and/or therapeutic (curative) treatment of colon
cancer (colon carcinomas), breast cancer (mamma
carcinomas), ovarian carcinomas, carcinomas of the
uterus, lung cancer, stomach cancer, liver cancer,
carcinomas of the pancreas, kidney cancer, bladder
30 cancer, prostate cancer, testicular cancer, bone
cancer, skin cancer, Kaposi sarcomas, brain
tumors, myosarcomas, neuroblastomas, lymphomas and
leukemias.

35 19. The metal cluster nanocompound as claimed in any
of claims 1 to 18 for the prophylactic and/or
therapeutic (curative) treatment of benign and
malignant tumors.

-36-

20. The metal cluster nanocompound as claimed in any of claims 1 to 19, which inhibits and/or stops cell growth and/or cell division of tumor and/or cancer cells and/or which induces destruction of tumor and/or cancer cell DNA.
21. The metal cluster nanocompound as claimed in any of claims 1 to 20, which can be administered systemically and/or topically.
22. The metal cluster nanocompound as defined in claims 1 to 21 and/or physiologically tolerated salts, derivatives, isomers, hydrates, metabolites and/or prodrugs thereof as active compound in pharmaceutical compositions or medicaments.
23. A pharmaceutical composition or medicament, comprising at least one metal cluster nanocompound as defined in claims 1 to 21 and/or physiologically tolerated salts, derivatives, isomers, hydrates, metabolites and/or prodrugs thereof, together with a pharmaceutically tolerated, essentially nontoxic carrier or excipient.
24. The pharmaceutical composition or medicament as claimed in claim 23, comprising the at least one metal cluster nanocompound as defined in claims 1 to 21 and/or physiologically tolerated salts, derivatives, isomers, hydrates, metabolites and/or prodrugs thereof in therapeutically active amounts.
25. The pharmaceutical composition or medicament as claimed in claim 23 or 24, furthermore comprising at least one further pharmaceutical active compound, in particular a chemotherapeutic and/or a cytostatic agent, present either as a functional unit, in particular in the form of a blend, a

-37-

mixture or a batch, or else (spatially) separated from one another.

26. The pharmaceutical composition or medicament as
5 claimed in any of claims 23 to 25 for systemic
and/or topical application.
27. The use of metal cluster nanocompounds as defined
10 in claims 1 to 21 and/or of physiologically
tolerated salts, derivatives, isomers, hydrates,
metabolites and/or prodrugs thereof for preparing
a medicament or a pharmaceutical composition for
the prophylactic and/or therapeutic (curative)
15 treatment of disorders of the human or animal
body, in particular of neoplastic and/or cancerous
diseases.
28. The use of metal cluster nanocompounds as defined
20 in claims 1 to 21 and/or of physiologically
tolerated salts, derivatives, isomers, hydrates,
metabolites and/or prodrugs thereof for the
prophylactic and/or therapeutic (curative)
treatment of disorders of the human or animal
25 body, in particular of neoplastic and/or cancerous
diseases.
29. The use as claimed in claim 27 or 28 for the
prophylactic and/or therapeutic (curative)
30 treatment of primary tumors and/or metastases
and/or precancerous diseases (pre-cancer stages).
30. The use as claimed in any of claims 27 to 29 for
the prophylactic and/or therapeutic (curative)
35 treatment of colon cancer (colon carcinomas),
breast cancer (mamma carcinomas), ovarian
carcinomas, carcinomas of the uterus, lung cancer,
stomach cancer, liver cancer, carcinomas of the
pancreas, kidney cancer, bladder cancer, prostate
cancer, testicular cancer, bone cancer, skin

-38-

cancer, Kaposi sarcomas, brain tumors, myosarcomas, neuroblastomas, lymphomas and leukemias.

- 5 31. The use as claimed in any of claims 27 to 30 for the prophylactic and/or therapeutic (curative) treatment of benign and malignant tumors.
- 10 32. The use as claimed in any of claims 27 to 31 inhibiting and/or stopping cell growth and/or cell division of tumor and/or cancer cells and/or for inducing destruction of the tumor and/or cancer cell DNA.
- 15 33. The use as claimed in any of claims 27 to 32, in which the metal cluster nanocompounds and/or their physiologically tolerated salts, derivatives, isomers, hydrates, metabolites and/or prodrugs are administered systemically and/or topically.
- 20 34. The use as claimed in any of claims 27 to 33 in combination with at least one further pharmaceutical compound, in particular a chemotherapeutic and/or a cytostatic agent, present either as a functional unit, in particular in the form of a blend, a mixture or a batch, or else (spatially) separated from one another, in particular in which the at least one further pharmaceutical active compound can be administered
- 25 simultaneously or else sequentially with respect to the metal cluster nanocompounds and/or their physiologically tolerated salts, derivatives, isomers, hydrates, metabolites and/or prodrugs.
- 30
- 35 35. A process for the prevention and/or treatment of disorders of the human or animal body, in particular neoplastic or cancerous diseases, using at least one metal cluster nanocompound as defined in claims 1 to 21 and/or physiologically tolerated

-39-

5 salts, derivatives, isomers, hydrates, metabolites
and/or prodrugs thereof in therapeutically active
amounts, together with a pharmaceutically
tolerated, essentially nontoxic carrier or
excipient.

- 10 36. The process as claimed in claim 35, in which the
metal cluster nanocompound and/or physiologically
tolerated salts, derivatives, isomers, hydrates,
metabolites and/or prodrugs thereof are
administered in combination with at least one
further pharmaceutical active compound, in
particular a chemotherapeutic and/or a cytostatic
agent, present either as a functional unit, in
15 particular in the form of a blend, a mixture or a
batch, or else (spatially) separated from one
another, in particular in which the at least one
further pharmaceutical active compound can be
administered simultaneously or else sequentially
20 with respect to the metal cluster nanocompounds
and/or their physiologically tolerated salts,
derivatives, isomers, hydrates, metabolites and/or
prodrugs.

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☒ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☒ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.